

REMARKS

In the Office Action mailed December 23, 2008, the Examiner rejected claims 21-23 under 35 U.S.C. § 102(b) as being anticipated by U.S. Pat. No. 4,072,607 to Schiller, et al (Schiller). Claims 21-23 and 26-39 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 6,222,083 to Colle et al. (Colle I) in view of Schiller. Claims 40-57 were rejected under 35 U.S.C. 103(a) as being unpatentable over Colle I in view of Schiller as applied to claims 21-23 and 26-39 in further view of U.S. Pat. No. 6,028,233 to Colle et al. (Colle II). Claims 26-39 were rejected under 35 U.S.C. 103(a) as being unpatentable over Schiller in view of Colle II. The Examiner also objected to claims 37-39, 44, and 55-57. Applicants herein present amendments, additional background art, and responses in light of the office action and the prior art. Applicants respectfully request reconsideration and an allowance of currently pending claims 21-23 and 26-57.

Specification Amendments

Applicants' amendments to the specification are corrections of obvious errors, are fully consistent with the application, and were previously submitted to the PCT. In paragraph [0058], the term "YCap" should be changed to "VCap." The term YCap is clearly a typographical error, as the remainder of paragraph [0058] refers to VCap. In Table 2, the labels for Example 5A and Example 5B were inadvertently reversed due to a scrivener's error. Paragraphs [0058] and [0059] discuss examples 5A, 5B, and 5C, describing 5A as "high molecular weight"; 5B and 5C as "low molecular weight." A review of Table 2 shows that GH 267 is high molecular weight; R5-772 and TR-544 are low molecular weight, given their weight distributions. The amendment is fully consistent with the disclosure.

Claim Amendments

Applicants believe the claim amendments are fully supported by the application as claims 38 and 56 were amended to simply change their dependency from claims 37 and 55, respectively to claims 26 and 40.

Claim Objections

The Examiner objected to claims 37-39, 44, and 55-57. Applicants present the following clarifying amendments and responses in order to overcome the claim objections. Applicants believe that the amendments to claims 38 and 56 effectively overcome the objections to those claims. Claims 37, 39, 55, and 57 all require three or more maxima, but were objected to because the claims from which they depend are limited to polymers with a “bimodal weight distribution.” However, the specification clearly states that the term “bimodal” is not limited to polymers having only two maxima, and may include polymers having three or more maxima. *See, e.g.* para [0033]. Claim 44 was objected to because the Examiner interpreted claim 40, upon which claim 44 depends, to be limited to a “bimodal molecular weight distribution ... of a single polymer.” However, the specification clearly discloses that the bimodal molecular weight distribution may be obtained by combining more than one polymer. *See, e.g.* paras. [0029]-[0031]. For at least these reasons, Applicants respectfully request removal of the objections to claims 37-39, 44, and 55-57.

Interview Summary

Applicants were provided the opportunity to telephonically interview the Examiner on January 15, 2009. Applicants and inventors Karla Colle and Larry Talley attended, along with Applicants’ representative, Adam Brown. Applicants appreciate the Examiner’s time and consideration in granting the interview.

Applicants discussed the Examiner’s inherency position regarding the composition of Schiller, showing that Schiller fails to disclose “clathrate hydrate inhibitors.”

Applicants further disclosed a showing of unexpected results in regard to the molecular weight distribution of the polymers to distinguish over Colle ‘083.

The Examiner rejected claims 21-23 under 35 U.S.C. § 102(b) as being anticipated by Schiller. Applicants respectfully traverse the rejection because the prior art fails to teach or suggest each element of the claims. As amended, claim 21 specifically requires, among other things, “contacting the fluid with an effective amount of *a clathrate hydrate inhibitor...*” The Examiner’s position is that Schiller inherently discloses a clathrate hydrate inhibitor because it discloses a polymer that inhibits scale formation. As discussed in the interview, only some polymers inhibit hydrate formation and the scale inhibitor polymer of Schiller is not such a polymer. In particular, Schiller teaches the use of an acrylamide monomer, which is known to be comprised of an NH₂ group. *See*, Schiller, Example 1. Schiller also specifically teaches the combination of low and high molecular weight polymers from U.S. Pat. No. 3,463,730, which specifically discloses a polymer structure having a monomer with an NH₂ group at column 3, lines 30-50. *See*, Schiller, Example 4. U.S. Patent number 5,600,044 to Colle, et al. (Colle III) shows that NH₂ polymers -like those disclosed in Schiller- do not improve hydrate formation inhibition. First, Colle III excludes NH₂ polymers from the definition of “effective hydrate inhibitors.” Colle III at col. 5, l. 64-col. 6, l. 15. Second, Colle III tests the NH₂ polymer (“PAM,” see col. 7, ll. 1-8) with other potential inhibitors in Table 1 and the PAM performs as if no hydrate inhibitor was used. Schiller does not disclose or suggest, implicitly or inherently, a clathrate hydrate inhibitor. For at least these reasons, it is believed that Schiller fails to anticipate claims 21-23.

Obviousness Rejections under 35 U.S.C. § 103

The Examiner rejected claims 21-23 and 26-39 under 35 U.S.C. § 103(a) as being unpatentable over Colle I in view of Schiller. Applicants respectfully traverse the rejection based on its previously filed remarks and a showing of unexpected results. As remarked above and in Applicants prior response, Schiller does not relate to hydrate inhibitors or the types of polymers disclosed in the application. Some of the claimed polymers are disclosed in Colle I. However, there was no appreciation by a person of ordinary skill in the art that those polymers would be more effective as bimodal polymers. At the time of the invention, it was known that low molecular weight polymers performed much better than high molecular weight polymers.

Experiments showed that for at least one known hydrate inhibitor (N-vinylcaprolactam or VCap), a number average molecular weight (M_n) of about 900 g/mole was ideal. Lower molecular weights could only be achieved using monomers of VCap, which were tested and found not to be effective hydrate inhibitors. As the molecular weight of the VCap polymer was increased, the effectiveness decreased rapidly until it eventually leveled off. These results were published in a thesis paper. MATTHEWS, P.N., "Quantification of Significant Variables in Kinetic Hydrate Inhibition," Colorado School of Mines M.S. thesis T-4987 (1997). Graph I showing hydrate inhibition results of a polymer at six different molecular weights is reproduced from page 65 of the thesis in an Addendum at the end of this response. To a person of ordinary skill in the art, it was established that low molecular weights were much more effective than high molecular weights for hydrate inhibition. It was further understood that "[t]ypically, properties and performance of polymer blends are the average of the two polymers." Application, paragraph [0067]. Hence, a person of ordinary skill in the art believed that blending a high molecular weight polymer with a low molecular weight polymer would result in a less effective polymer than the low molecular weight polymer. There was no evidence or teaching in the art to suggest that adding the less effective high molecular weight polymers to the more effective low molecular weight polymers would result in a better hydrate inhibitor. Schiller does not change this understanding because Schiller does not apply to hydrate inhibition generally or to the types of polymers disclosed in the application.

In light of the preference for low molecular weight polymers, Applicants requested a third party to make some hydrate inhibiting low molecular weight polymers to test in Applicants' research facilities. The third party inadvertently made a sample of hydrate inhibitor with a mixture of low molecular weight polymer and high molecular weight polymer. Upon testing this "bimodal" polymer sample with a "properly made" low molecular weight (LMW) polymer known to inhibit hydrate formation, the bimodal polymer unexpectedly out-performed the LMW polymer.

A comparison of bimodal polymers with high molecular weight (HMW) polymers and LMW polymers are provided in Table 1 and Table 2 of the application. Examples 3D-3F in

Table 1 are LMW polymers with expectedly good performance (e.g. subcooling temperatures – T_{sub} – from about 25°F to about 33°F). Example 2 is a HMW polymer with an expectedly weak performance (T_{sub} of about 18°F). In describing these results, However, in Example 1B, where the LMW polymer of Example 3D is blended with the HMW polymer of Example 2 to form a “bimodal” polymer, the result is a much better performance (T_{sub} of 43.5°F) than either polymer independently. Graph II in the Addendum at the end of this response shows the results of Table 1 in graphic form. Table 2 shows a similar result to Table 1, where Example 4 is a bimodal polymer blending the HMW polymer of Example 5B (T_{sub} of 18°F) with the LMW polymer of Example 5C (T_{sub} of 30°F) to obtain a superior result (T_{sub} of 34°F). These unexpected results led to the presently claimed subject matter. For at least these reasons, claims 21-23 and 26-39 are patentable over Colle I in view of Schiller and allowance of these claims is earnestly solicited.

The Examiner also rejected claims 21-23 and 26-39 under 35 U.S.C. § 103(a) as being un-patentable over Schiller in view of Colle I. Applicants believe that the unexpected results combined with the inapplicability of Schiller discussed above are sufficient to overcome this rejection. Allowance of these claims is earnestly solicited.

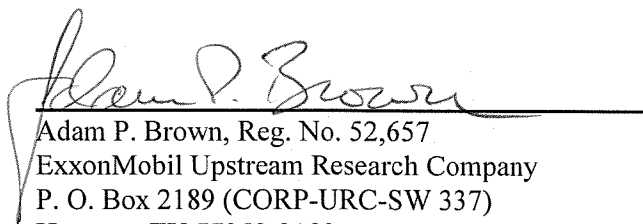
The Examiner rejected claims 40-57 under 35 U.S.C. § 103(a) as being un-patentable over Colle I in view of Schiller in further view of Colle II. Applicants believe that the unexpected results combined with the inapplicability of Schiller discussed above are sufficient to overcome this rejection. Allowance of these claims is earnestly solicited.

The Examiner also rejected claims 26-39 under 35 U.S.C. § 103(a) as being un-patentable over Schiller in view of Colle II. Applicants believe that the unexpected results combined with the inapplicability of Schiller discussed above are sufficient to overcome this rejection. Allowance of these claims is earnestly solicited.

CONCLUSION

In view of the amendments and remarks set forth above, Applicants respectfully request allowance of all pending claims 21-23 and 26-57, removal of the objections to the claims, and issuance of a notice of allowance of all pending claims. No other fees are believed to be due at this time, however, the Commissioner is hereby authorized to charge the Deposit Account No. 05-1328 for any additional fees associated with this application. Further, if the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Adam P. Brown", is written over a horizontal line.

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